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BEWARE THE BITE!

Electrical Safety

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Electrical Safety

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Introduction

Electrocution is the second biggest killer of employees in general industry. To protect you, the Occupational Safety and Health Administration (OSHA) published the rule for safe electrical work practices. Following this regulation can help you work safely.

Levels of Protection

There are three basic levels of protection to help you work safely around electricity:

- Engineering controls
- Safe work practices
- Personal protective equipment (PPE).

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Engineering Controls

Whenever possible your employer provides engineering controls to eliminate shock hazards. Insulation is one such engineering control. A material with little or no conductive properties is used to put a barrier between you and a flowing current. Glass, rubber, mica and some plastics make good insulators.

To prevent you from contacting live wires or parts, junction boxes must not have holes in their covers. Unfortunately, let a little weather, hard use or age affect these engineering controls — and the threat of injury returns.

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Safe Work Practices

Safe work practices are developed through training.

- Always inspect your tools before you work.
- Remember that insulated grips on electrical tools protect you only when the insulation is free from cracks, tears and worn spots.
- Rely only on factory-manufactured insulation, because home-made insulation can expose you to deadly electrical current.
- Check power tools to see that double-insulated casings and third-wire power cord grounding work properly.
- Check to see that safety guards or shields are in place, switches have secure terminals and cords are not frayed or cut.

Inspect Portable Extension Cords.

- Be sure the cord is rated for the tool you're using and your work environment.
- Make sure the cord you are using is a three-wire cord with a working ground fault circuit interrupter (GFCI).
- Before your shift begins, check the cord for loose parts, deformed and missing pins, or damage to its outer jacket or insulation.
- Be sure the plug and receptacle are designed to be used together.
- Remember that switches, components and wiring won't stand up to rough handling.
- Never raise or lower equipment by its flexible cord because this could damage the insulation.

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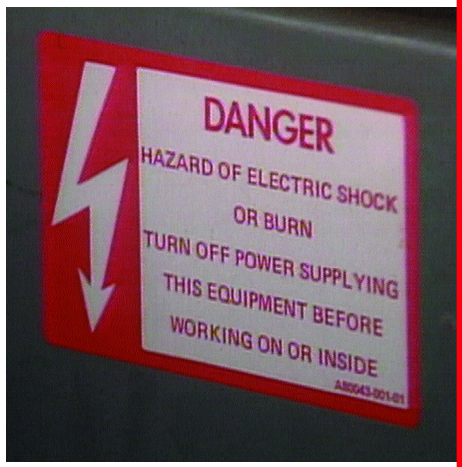
Read and Follow Symbols, Signs and Barriers.

- Stop bars and emergency cut-off switches are usually red.
- Orange sometimes marks dangerous exposed machine parts or electrical hazards.
- Yellow calls for caution.
- Green shows where to find safety items.



Work Safely Around Flammable Dust and Vapors.

- Air full of combustible dust, flammable fumes or excess oxygen can be ignited by a stray spark.
- Ventilation is one way to lower the concentration of atmospheric hazards in your work area.

Use Proper Lighting.

- If you can't see well enough to work safely, set up approved portable lighting.

Housekeeping.

- Keep tools clean and arranged conveniently because a little oily film or carbon deposit can conduct electrical current.
- Clean up spills immediately.
- Even sweat conducts electricity — so keep a towel or rag handy.
- Never work with electricity in wet weather.

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Lockout/Tagout

Lockout/tagout can save your life. Before working on circuits and equipment, follow your facility's procedures to the letter.

- **Locks** — Place a lock on each disconnecting means, such as a switch or circuit breaker, which could energize the line.
- **Tags** — If tagging alone is permitted, use an additional safety measure, such as removing fuses, blocking control switches or opening an extra disconnect device.
- Never remove a lock or tag applied by someone else. Some facilities require removal of locks and tags at the end of each shift with replacement locks and tags applied by oncoming employees.
- Treat conductors and parts of equipment that have not been locked out or tagged as if they are energized.

- Watch out for additional stored energy. Even when equipment is locked out, it's still possible that energy from an additional source can inflict deadly shock.
- Check to see that all power sources are controlled. Never try to find out if there's voltage left in a disconnected circuit by touching the equipment. Instead, read the manufacturer's service manual or updated diagrams for the particular system you are working on.

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- Look for capacitors and other forms of stored energy. To discharge capacitors, connect a grounding wire from the capacitor to a known grounding source.
- Disconnect or cap auxiliary power sources, such as secondary electrical, steam, hydraulic or pneumatic systems. This includes checking that all moving parts have stopped turning, relieving trapped pressure, blanking pipe flanges, installing ground wires to discharge electrical capacitors and blocking or supporting elevated equipment.
- Return all controls to the OFF or NEUTRAL position, and apply your lock and tag.
- Verify isolation. After you're sure that no people are exposed, operate the push button or other normal operating controls to make certain the equipment will not operate.
- Check to see that the main disconnect or circuit breaker cannot be moved to the ON position.
- Use a voltage meter to check for voltage.
- Press START buttons and other activating controls.
- Shut off machine controls.

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Energizing Electrical Systems

When work is complete on an item of electrical equipment:

- Inspect the entire work area to be sure all tools, jumpers, grounds and other devices are removed.
- Warn co-workers to stay clear of the equipment being returned to service.
- Remove locks and tags. Then operate energy isolating devices to restore energy.
- Ensure that equipment is safe to operate. Make sure all guards are installed and that blocks, braces and grounds are removed.
- Count co-workers to be sure everyone is clear of equipment.
- Notify everyone affected that the system is being returned to normal operation before you re-energize the system.
- Remove locks and re-energize.

Qualified Electrical Workers

- A qualified person is specifically trained in the hazards of working on energized parts and equipment.
- Being qualified to work on one type of equipment does not necessarily mean you are qualified to work all equipment.
- Being qualified means you are allowed to work on energized systems.

Sometimes turning equipment off increases hazards such as interrupting life-support systems or deactivating emergency alarm systems or ventilators. Only qualified persons familiar with the operation of the equipment are allowed to work on it.

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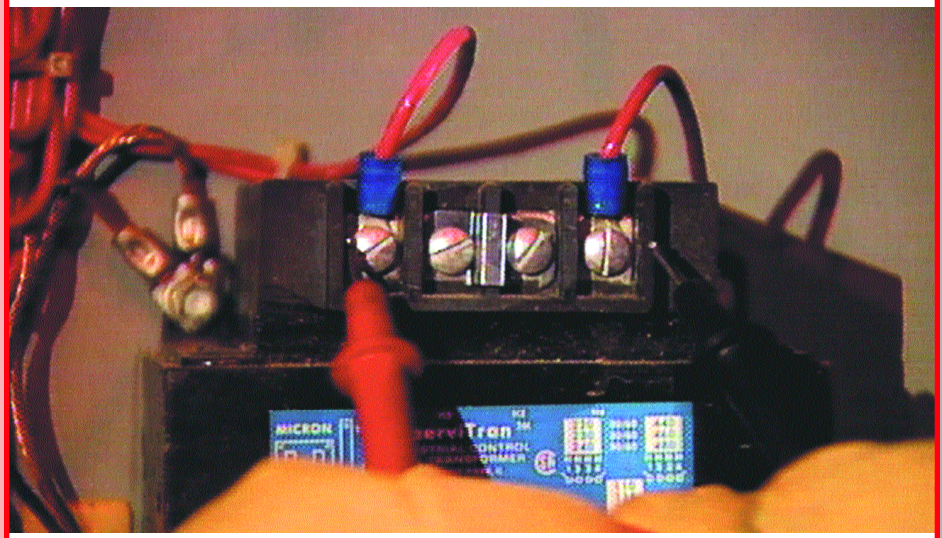
Working with Energized Systems

Whether you are qualified or simply competent, you should never work on unfamiliar equipment.

- Check all built-in safety features and don't rely blindly on internal safety devices such as fuses, circuit breakers or protective interlocks.
- When de-energizing is impossible for such procedures as troubleshooting or testing, use a glow tester to check for power in a high-voltage line.
- Remember that live-circuit work hazards are so serious that trained workers must strictly follow acceptable safe work procedures.



Work Safely with Test Equipment.

Test equipment — from a simple voltmeter to a complicated circuit analyzer — is really just another tool, and the same basic rules apply.

- Always choose the tester that is right for the job and use safe testing procedures.
- Never exceed equipment limitations and don't abuse testers. Rough handling damages switches and components which may cause faulty grounding.
- Inspect testers often. Check probes and leads for defects. Make sure they have insulated stops to keep your fingers from sliding onto leads.

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Personal Protective Equipment

When engineering controls and safe work practices are in place you have one extra line of defense: personal protective equipment (PPE).

- Select the proper equipment and check it periodically for good repair.
- If you need a ladder, use only a sturdy one made of wood or fiberglass. Aluminum ladders conduct electricity. Rubber feet or end caps give added protection since they are non-conductive and won't skid.
- Always wear a good pair of safety shoes with insulated soles and heels.
- Make sure clothing is comfortable, and wear buttoned shirt cuffs and no neckties or scarves.
- Remove all jewelry, rings and metal wristwatches. Gold and silver are excellent conductors and can make you part of a live circuit. A short circuit through jewelry could ruin sensitive electronic circuits.
- A standard electrician's tool belt is okay, but remember that metal rivets can conduct electricity. In tight spaces, take the tool belt off before starting work. Dangling tools can drop into operating equipment or across electrical connections.
- Use the proper PPE for the job. Personal protective equipment is designed and made of materials to protect you in many ways.

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- Non-conductive head protection can protect you when there is danger of head injury from electric shock or electrical burns.
- Eye and face protection protects you from electric arcs or flashes and from flying objects when there is an electrical explosion.

n Inspect and protect your PPE before you use it and protect it from damage. One way to protect rubber insulating material is to use an outer leather covering.

Working with Overhead Lines

Although all energized circuits are electrical hazards, none has caused more deaths than overhead power lines. If you are a qualified worker, you may be required to work directly on energized overhead lines. For safety's sake:

n Observe clearance distances. If you are an unqualified worker, neither you nor anything you touch can get within 10 feet of an overhead line carrying up to 50 kilovolts (KV). When voltage to ground is 50 kilovolts or above, you must maintain 10 feet of clearance and add 4 inches for every 10KV over 50KV. For example:

Voltage		Clearance
50KV	=	10 feet
60KV	=	10 feet, 4 inches
70KV	=	10 feet, 8 inches

As a qualified worker you may work closer than 10 feet from these lines while you are either in an elevated position or on the ground. However, be sure to:

n Use hand-held working devices with approved insulating handles.

n Use gloves rated for the voltage involved.

n Be sure you're insulated from any conductive objects and energized parts.

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Emergency Rescue

Know what to do to protect yourself and know how to aid a shock victim.

n Find out if the person you are helping is in contact with an energized circuit and then shut it down — before you approach the victim.

n If you are not sure whether the victim is clear of the energized source, assume that the person may shock you if you touch the person.

n If you have to move the victim off a live circuit, use something non-conductive such as a dry wooden chair, board, pole, plastic pipe or rope.

First Aid

Once you have safely separated a shock victim from an energized circuit, call or send for emergency medical help. Then decide what first aid you should give.

n Always quietly reassure and calm an injured person. If the victim is standing, have the person lie down.

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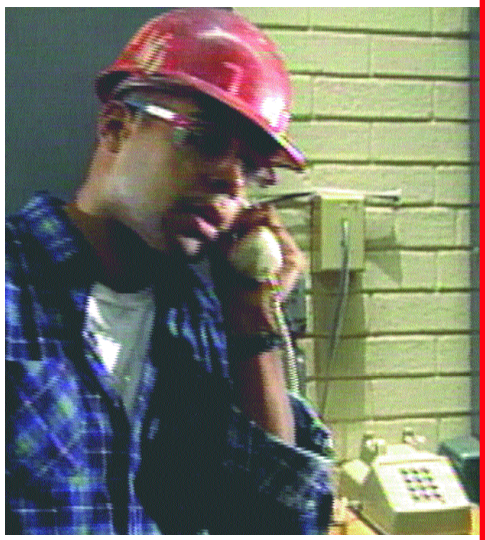
- If the victim is not breathing, the lungs may have been paralyzed by the shock. If that is the case, apply CPR until qualified medical assistance arrives.
- If any bleeding occurs, you should stop it by applying direct pressure on the wound after first protecting yourself from bloodborne pathogens.
- Remember that traumatic shock may occur with electric shock, when vital body systems can shut down or function abnormally.



Traumatic Shock Treatment.

The following are examples of what you may encounter when an electric shock victim's body is in traumatic shock and instructions for what you should do to help:

- The victim's muscles are usually weak, breathing is slow, heartbeat is slow and blood pressure is weak.
- Loosen the victim's clothing. If the person's skin is unnaturally warm, cool it by fanning. If the skin is cold and clammy, cover the victim with a jacket or a blanket.
- If the victim's face is pale, it means there is not enough blood flow to the head. Raise the person's feet higher than the head.
- If the victim's face is unusually red, there is too much blood flow to the head. Position the victim so that the victim's head is higher than the feet.

Remember: The first aid you provide may save a life. Review first-aid procedures often.

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Summary

You have learned how to work safely with electricity and that it can strike the complacent and the unwary with unseen, fast and deadly results.

If you are not sure about safe procedures or conditions, don't do that job until you are sure. Remember, ignoring the potential dangers of electricity may cost you your life.

Work smart... and beware the bite.

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Quiz

1. True False OSHA's electrical safety standard contains procedures to protect you.
2. True False Training is the third level of protection for electrical workers.
3. True False Engineering controls are usually made of conductive materials.
4. True False Orange safety signs sometimes mark dangerous exposed machine parts and electrical hazards.
5. True False If you use a tag to warn of electrical hazard, you do not have to use additional measures.
6. True False As long as you are qualified, and it is daylight, it is not necessary to use artificial lighting to aid you in working on an energized circuit.
7. True False Since grounded outlets cannot be over-loaded, you may use more than two plugs per double outlet.
8. True False Part of the lockout/tagout procedure is to verify that the main disconnect or circuit breaker cannot be moved to the ON position.
9. True False When performing lockout/tagout you don't need to verify the isolation of the equipment as long as it is turned off.
10. True False Before re-energizing a circuit, you should count your co-workers to be sure everyone is clear of the equipment.
11. True False You do not have to be a qualified worker to use test equipment.
12. True False You may discharge stored voltage through temporary ground wires with a clean ground contact point to a main earth ground.

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13. True False A qualified worker can work on any electrical equipment.
14. True False If you are a qualified worker, you may remove a lock or tag even if someone else attached them.
15. True False Non-conductive head protection as well as eye and face protection are specialized equipment not necessarily needed by qualified electrical workers.
16. True False Green signs indicate where to find safety items.
17. True False An unqualified worker must stay at least 10 feet away from energized lines.
18. True False The first step in rescuing a shock victim is to attempt to find out if the victim is in contact with an energized circuit and then shut it down.
19. True False A plastic pipe may be used to remove an electric shock victim from contact with an energized source.
20. True False If a victim of electric shock has a red face, you should raise the person's feet so they can breathe more easily.

ACKNOWLEDGEMENT OF TRAINING

I have read and understand the training handbook, **Electrical Safety: Beware the Bite.** I have also completed and passed the comprehensive quiz at the conclusion of this handbook.

_____ _____

Employee's Signature Date

_____ _____

Trainer's Name Date

NOTE: This record may be included in the employee's personnel or training file.

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